

REMARKS

The Office Action mailed September 8, 2006 has been received and the Examiner's comments carefully considered. Claims 20 and 23 have been amended, claim 24 has been canceled without prejudice, and new claims 25-34 have been added. Claims 20, 21, 23 and 25-34 are presently pending in this application. Reconsideration of the application, as amended, is respectfully requested.

A. Interview Summary

Two phone interviews were conducted between the undersigned and Examiner Tran. The first phone interview occurred on September 20, 2006, and the second phone interview occurred on October 31, 2006.

At the phone interview of September 20, 2006, United States Patent No. 4,282,713 was discussed with regard to the claims of the present application. No specific agreement with respect to the claims was reached. Instead, the undersigned agreed to provide a modified claims set for discussion at a subsequent phone interview.

At the phone interview of October 31, 2006 the undersigned and Examiner Tran discussed a proposed amended claim set. Certain claims of the proposed amended claim set related to retrofitting methods whereby a blow-by filter was identified as a separate structure from an intake air filter. Examiner Tran agreed that such structure distinguished the '713 patent. However, Examiner Tran indicated that further searching would be required in view of the claim amendments. The article entitled "Closed Crank Case Filtration: The Next Step in Diesel Engine Emissions Reduction", by Marty Barris, was also discussed at the phone interview.

B. Support for Claim Amendments

Support for the 25 percent or greater reduction in particulate matter emissions can be found at least at page 33, lines 6-16. The use of an air filter and a blow-by gas filter is shown at Figure 1 of the specification and described at page 5, lines 5-25 of the specification.

C. Overview

The present invention, as claimed, constitutes a "paradigm shift" in the approach to retrofitting in-service diesel engines to reduce emissions. Prior art diesel engine exhaust retrofit strategies such as the Lubrisol Engine Control System approach described at paragraph 9 of the Imes Declaration (submitted previously with Amendment of January 23, 2006) have focused on modifying diesel engine exhaust systems to include a treatment device at the exhaust pipe only. In stark contrast, the presently claimed invention relates to retrofitting an in-service diesel engine by using a combination of blow-by gas treatment technology and tailpipe exhaust treatment technology to achieve enhanced and unexpected results. This unique retrofit strategy can be used to comply with stringent emissions regulations and provides significant benefits to end users by providing enhanced emissions reductions for in-service diesel engines.

D. Claim 20

Claim 20 was rejected under 35 U.S.C. § 103(a) as being unpatentable over *Antoku et al.* (US Patent No. 4,282,713). This rejection is respectfully traversed. However, in the interests of expediting prosecution, the claim has been amended to more clearly define certain inventive aspects.

For numerous reasons, the disclosure of *Antoku* does not render obvious the method for retrofitting defined by claim 20. At least some of the reasons why claim 20 is patentable are set forth below.

1. **Antoku is silent as to a method of retrofitting.**

Claim 20 relates to a method for **retrofitting** an engine to reduce particulate matter emissions. By comparison, *Antoku* merely discloses an engine system that includes exhaust treatment. Nowhere does *Antoku* teach or suggest that the system disclosed therein could be used for retrofitting an existing in-service engine. Absent such teaching or suggestion, it is not reasonable to conclude that one of skill in the art would find it obvious to use the system disclosed in *Antoku* as a basis for retrofitting an in-service engine. There is simply no motivation that supports such a conclusion. Therefore, it would appear that the Examiner's reliance on

Antoku as a basis for rejecting claim 20 was the result of hindsight reconstruction based on Applicants' disclosure. This type of hindsight reconstruction is clearly impermissible.

2. Antoku is not identified as a diesel system.

Claim 20 relates to a method for retrofitting a **model year 1991-2003 on-highway diesel engine rated to produce between 150 and 600 horsepower**. Diesel engine exhaust is very different from gasoline spark ignition engine exhaust (see paragraph 4 of the Stenersen Declaration included as Exhibit 1). For example, diesel engine exhaust is typically much higher in particulate matter than gasoline spark ignition exhaust, while gasoline spark ignition engine exhaust is higher than diesel engine exhaust in harmful gas emission such as carbon monoxide, NO_x and various hydrocarbons or volatile organic carbons. The differences in exhaust content are directly related to the differences in the compositions and combustion reactions of the fuels (see paragraph 4 of the Stenersen Declaration).

The system disclosed in *Antoku* is not identified as being a diesel system. To the contrary, one of skill in the art would reasonably conclude that *Antoku* discloses a gasoline spark ignition engine system, not a diesel engine system (see paragraph 6 of the Stenersen Declaration). One basis for this conclusion is that the catalytic converter 16 of *Antoku* is identified as a three-way catalytic converter (see column 3, lines 8-10 of the '713 patent). Three-way catalytic converters are used to treat gasoline spark ignition engine exhaust, not diesel engine exhaust (see paragraph 8 of the Stenersen Declaration). Another basis for this conclusion is that the ignition advance system disclosed by *Antoku* (see column 6, lines 45-58) is representative of the type used in gasoline spark ignition engines, not diesel engines (see paragraph 7 of the Stenersen Declaration). A further basis for this conclusion is that the vacuum generating throttle valve 26 disclosed in *Antoku* is representative of the type used in gasoline spark ignition engines, not diesel engines (see paragraph 9 of the Stenersen Declaration). Still another basis for this conclusion is that the injection of fuel into the intake manifold by injection valves 28 is consistent with a gasoline spark ignition engine, not a diesel engine (see paragraph 10 of the Stenersen Declaration).

Because of the significantly different makeup between diesel engine exhaust and gasoline spark ignition engine exhaust, one of skill in the art would not reasonably look to a gasoline

spark ignition engine system as disclosed in *Antoku* for teachings regarding retrofitting diesel engine exhaust systems. Hence, there is no reasonable basis for concluding that it would have been obvious to use the system disclosed in *Antoku* to retrofit a model 1991-2003 on-highway diesel engine rated to produce between 150 and 600 horsepower.

3. Antoku does not disclose performance information.

Claim 20 specifies that the combined reduction of the blow-by gas emissions and the exhaust gas emissions provides at least a 25 percent reduction in emissions in a model year 1991-2003 on-highway diesel engines. This emissions reductions level corresponds to Level 1 of the California Air Resources Board regulations and is a difficult standard to meet for model year 1991-2003 on-highway diesel engines. Nothing in *Antoku* teaches or suggests that the system disclosed therein would satisfy this level of performance. Absent such a teaching or suggestion, there is no reasonable basis for concluding that the system disclosed in *Antoku* would achieve comparable results if used on such diesel engines. This is particularly true since, as indicated above, the system disclosed in *Antoku* is designed for use with gasoline spark ignition engines rather than diesel engines.

4. Antoku does not disclose an air filter and a blow-by gas filter.

Claim 20 relates to a method for retrofitting a model year 1991-2003 on-highway diesel engine that draws intake air through an intake air system including an air filter for filtering the intake air. The retrofitting method involves installing a blow-by filter in gas-flow communication with a blow-by vent structure of the diesel engine and further in gas-flow communication with the engine air intake structure. After retrofitting, the diesel engine includes both an air filter for filtering the intake air, and a blow-by gas filter. No such structure is disclosed or suggested in *Antoku*. Instead, *Antoku* only discloses the presence of a single air filter.

5. Secondary considerations support a finding of non-obviousness.

Secondary considerations can be the most probative and cogent evidence with respect to the issue of obviousness (see Arkie Lures, Inc. v. Gene Larew Tackle, Inc., 119 F.3d 953 (Fed.

Cir. 1997)). In the present case, secondary considerations such as satisfaction of a long felt need and evidence of copying are particularly probative.

a. Satisfaction of a long felt need

Providing a cleaner environment by reducing exhaust emission has long been a priority in the United States. For this reason, the market for diesel exhaust emission control retrofit devices is highly competitive and technology-driven. See Imes Decl. ¶ 2 submitted previously with Amendment of January 23, 2006. Despite the competitive nature of this field of business, the competition failed to combine tailpipe exhaust treatment technology with crankcase emissions filtration technology for diesel retrofit applications. As shown by tables 1-3 of the present application, Applicants' combination of tailpipe treatment with blow-by gas filtration for diesel retrofit applications unexpectedly resulted in significantly higher particulate matter removal rates than tailpipe treatment alone. For example, the tables show that systems in accordance with the principles of the present invention improve particulate filtration efficiencies by amounts ranging from 6.3 percent to 17.1 percent as compared to systems using tailpipe treatment alone. Furthermore, Applicants' invention is applicable to a wide range of different diesel engine models. In view of the wide applicability of Applicants' invention and the significant improvement in performance yielded by Applicants' invention as compared to tailpipe treatment alone, if the invention were truly obvious, it is likely that it would have been adopted by other competitors.

b. Evidence of Copying

The competition has been quick to follow the retrofit strategy innovated by Applicant. For example, Engine Control Systems (ECS) has now received EPA verification for its AZ Purifier/ AZ Purimuffler Diesel Oxidation Catalyst with ECS Closed Crankcase Ventilation (CCV) system (see Exhibit 2). This system is verified for use in retrofitting 1991-2004 diesel engines, and has been shown to provide particulate matter reductions in excess of 40 percent. As shown at Exhibit 3, the AZ Purifier is a diesel oxidation catalyst (i.e., a catalytic converter) and the AZ Purimuffler is a muffler containing a diesel oxidation catalyst. Exhibit 4 shows that the ECS Closed Crankcase Ventilation system includes filtration for filtering blow-by gas.

As set forth above, secondary considerations can be the most probative and cogent evidence with respect to the issue of obviousness. Therefore, the above objective evidence overwhelmingly support the position that Applicant's invention, as defined by claim 20, is not obvious in view of the prior art.

E. Dependent Claims 21, 25 and 26

Dependent claims 21, 25 and 26 depend upon and further limit claim 20. Therefore, for at least the same reasons specified with respect to claim 20, it is submitted that these claims are in immediate condition for allowance.

F. Claim 23

Claim 23 was rejected under 35 U.S.C. § 103(a) as being unpatentable over Antoku et al. (US Patent No. 4,282,713). This rejection is respectfully traversed. However, in the interest of expediting prosecution, claim 23 has been amended to more clearly define certain inventive aspects of the invention.

Claim 23 relates to a method for certifying compliance with governmental regulations for an emissions reduction retrofit of model year 1991-2003 on-highway diesel engines rated to produce from 150-600 horsepower. As described above, *Antoku* fails to provide any suggestion that the system disclosed therein could be used to retrofit a diesel engine. Moreover, numerous steps recited in claim 23 are completely absent from *Antoku*. For example, all of the measuring steps are absent from *Antoku*. Furthermore, *Antoku* provides no basis for concluding that the system disclosed therein could provide the 25 percent reduction in particulate matter emissions as required by claim 23. For at least the above-identified reasons, it is submitted that claim 23 is not rendered obvious by *Antoku*, and is in immediate condition for allowance.

G. New Claims 27-34

New claim 27 relates to a method for retrofitting a diesel engine by installing both a blow-by filter and an exhaust treatment device. The blow-by filter and the exhaust treatment device are configured to provide a reduction in total engine particulate matter emissions that exceeds 25 percent when the blow-by filter and the exhaust treatment device are used to retrofit a

model year 1991-2003 on-highway diesel engine rated to produce from 150-600 horsepower. For at least some of the reasons identified previously, it is submitted that claim 27 is patentable over the prior art of record in the present case. Therefore, allowance of claim 27 is respectfully requested. Additionally claims 28-34 depend upon and further limit claim 27. Therefore allowance of such claims is also requested.

H. Conclusion

In view of the above amendments and remarks, it is submitted that the claims of this application are in immediate condition for allowance and notification of such is respectfully requested. Please direct any inquiries concerning this application to the undersigned attorney at 612-336-4617.



Dated: _____

12/21/06

Respectfully submitted,

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